"Vetiver System Contribution for Wetland Rehabilitation in Ethiopia: The Case of Wichi Wetland and Micro Watershed, Metu District"

by
Afework Hailu
Ethio Wetlands and Natural Resources Association
P. O. Box 1518 Code 1110, Addis Ababa, Ethiopia
email: ewrp@ethionet.et; Website: www.ewnra.org.et

A paper presented at the workshop entitled:
The Vetiver System for Water and Soil Conservation, Environmental Protection and Land Rehabilitation in Ethiopia

March 16 -18, 2009
Addis Ababa, Ethiopia

"Vetiver System Contribution for Wetland Rehabilitation in Ethiopia: The Case of Wichi Wetland and Micro Watershed, Metu District"

Abstract

Wichi wetland and its watershed, which is the focus of this paper is located at $8^0$15'- $8^0$19' N and $35^0$40' – $35^0$45' E, and stretches from 4 to 25 kms west of Metu Township, Illu Aba Bora Zone, Southwest Ethiopia.

Due to long history of unsustainable use of Wichi Micro Watershed including the wetland, the natural resources within the micro watershed were severely degraded and the socio-economic and ecological services that wetlands generate were discontinued and the wetland had become a rough grazing site. The vegetation within the wetland was affected and the level of the wetness of the wetland was completely altered. Due to this the water birds which were once the beauty of the wetland completely evacuated and biodiversity value of the wetland was severely degraded.

Furthermore, with continuous cultivation without proper soil and water conservation practice, deforestation, unsustainable agricultural expansion with population increase and overgrazing the catchment was exposed to severe degradation. At the time of designing ***Integrated Wichi Wetland and Micro Watershed Project,*** communities have reported soil erosion as one of the major problem that has significantly contributed to soil fertility loss hence for severe crop productivity decline in their area

In order to address the problem, the aforementioned ***Project*** was implemented within Wichi Micro Watershed with main goal of implementing integrated wetland and catchment management activities with active involvement of local communities in order to improve the economic and environmental values of the wetlands and the catchment resources to contribute towards food security and livelihoods of the community who depend on them and to sustain the benefits beyond for the coming generation.

Accordingly over the project life 820 kilometers of Fanya juu, 70.80 kms of soil bund, 4.65 kilometers of waterway, and 25.5 kilometers of cut-off drain were constructed within Wichi Micro Watershed over 1018 hectares. Further to arrest the problems EWNRA has established two nursery sites in the intervention micro watershed and raised more than 2,000,000 Vetiver tillers and distributed and were planted.

The deliberate actions that were taken within the catchment which aimed to address the wetland and the catchment problems over time have resulted in a positive outcome both within the wetland ecosystem and upslope. The positive impacts of the project interventions include water quantity increase within the wetland which has a direct positive impact both on the wetland vegetation and wildlife. Due to increased water level in the wetland as a result of extensive soil and water conservation activities within the catchment the wetland vegetation re-emerged and water birds that were locally extinct from the wetland prior to project intervention have started to fly back in large numbers. Non-wetland plant species were gradually replaced with wetland species and biodiversity has started to flourish again. Siltation within the wetland has reduced. Moreover, soil erosion is reduced significantly within the catchment and this has contributed for improved soil fertility and crop productivity (better food availability), and better feed for livestock. Its cumulative effect is reviving of the Wichi wetland-watershed together with its water, biodiversity and livelihood.

1. Introduction

Wetlands are complex habitats with various definitions due to their wide range of habitats and ecosystems, which support highly adapted characteristic fauna and flora. Wetlands are so variable that their appearance and boundaries fluctuate over time. These dynamic changes are what make wetlands difficult to define. However, wetlands have unique characteristics and may be defined as;

> *"Those areas that are saturated by surface or ground water at a frequency and duration sufficient to support a prevalence of vegetation typically adapted for life in saturated soil conditions"* (Oonyu, (2008).

Wetlands may also be defined as areas of land that are wet, flooded either permanently or seasonally and where land retains water for long enough to allow the development of characteristic soils, plants and animals. According to the Ramsar Convention (1971), wetlands are defined as "*areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six meters"* .

Wetlands exist all over the globe in many forms from tropics to the pole and from highlands to lowlands. Ethiopia is also endowed with variety of wetlands that accounts for 2% of the total land mass of the country (FAO 1984, EPA 2005). In Illu Aba Bora wetlands accounts for 5% of the total area of the Zone (Afework, *et al.* 2000), and by Riverine (permanent rivers and streams, river side flood plains, etc) and Palustine (marshes, swamps, peat lands, etc) wetland types dominates the zone. Most of the wetlands are situated in valley bottoms and there is physical and ecological connection between the wetlands in the valley bottoms and the upslope.

In Illu Aba Bora Zone wetlands play an important role in the livelihoods of local communities who depend upon them for food production, raw material collection, water, grazing and as well as environmental functions. An increase in population in recent years and the expansion of coffee cultivation, however, has resulted in a shortage of agricultural land on the uplands, hence the drainage and cultivation of wetlands has expanded rapidly. Similarly, wetlands are increasingly being used for grazing cattle and the cultivation of eucalyptus trees as the availability of land on the uplands becomes scarce. Consequently there are indications that many wetlands are beginning to degrade and lose their capacity to provide the range of functions and benefits they have traditionally provided. In particular, water table levels are falling and this has a direct impact on the availability of drinking water from the springs around the edges of the wetlands. Any action up slope has a direct impact on the wetlands hence there rehabilitation, management and conservation should target the problem in a holistic approach through integrating actions from upslope down to the wetland level.

Thus this paper builds on the achievements made through implementing a project entitled: "*Integrated Wichi Wetland and Micro Watershed Project*" within Metu Woreda, Illu Aba Bora Zone Oromia Regional State, Southwest Ethiopia which involve various actions upslope including promotion of **Vetiver** to reduce the pressure on the wetland and rehabilitate the wetland system. The wetland situation within Metu Woreda in general and that of Wichi Micro Watershed in particular are not different than that of the Illu Aba Bora Zone wetlands. The facts highlighted above in this paper on Illu Aba Bora wetlands are similar to that of the project intervention area.

The information provided here is totally the outcome from the abovementioned project intervention and based on the project reports, discussions made with local residence of the micro watershed who are the direct beneficiaries from the project intervention, field observation, as well with staff from Metu Woreda Agricultural and Rural Development Office and impact monitoring report.

Photo 1. Partial View of Wichi Wetland and Micro watershed

2. Background and goal of Integrated Wichi Wetland and Watershed Project

The "*Integrated Wichi Wetland and Watershed Project*" was designed four years back to address wetland and watershed problems that were encountering Wichi Wetland and the whole micro watershed with full participation and involvement of all stakeholders mainly the local communities, woreda (district) development actors and administrative authorities. The project was implemented over four years, from 2005 to end of 2008 with financial support available from SIDA through Sustainable Land Use Forum (SLUF) one of umbrella environmental organization within the country. The overall project goal was to: *"implement integrated wetland and catchment management practices with the involvement of the local communities and thereby to improve the economical and environmental values of the wetlands and the catchment resources to contribute towards food security and livelihoods of the community who depend on them and to sustain the benefits for the coming generation."*

In order to meet the project goal a number of project components were identified with the help of local communities and implemented over the project life. Out of those components one of the key component of the project was designed to halt soil and water erosion through biophysical action which involves construction of physical soil and water conservation structures coupled with Vetiver rising and planting to reinforce the constructed structures.

This component was targeted to fulfil additional goal mainly to rehabilitate Wichi Wetland which was under severe threat from anthropogenic factors that were completely altering the nature and the ecosystem of the wetland.

3. Location, agro-ecology and landuse in Wichi Micro Watershed

Wichi wetland and the micro watershed are located at $8^0$15'- $8^0$19' N and $35^0$40' – $35^0$45' E, and stretches from 4 to 25 kms west of Metu Township, Illu Aba Bora Zone, Southwest Ethiopia. The altitude of the micro watershed varies from 1680 meters to 1750 meters above sea level in the western part and eastern part of the micro catchment respectively and undulates towards the western part and characterized as *Wet Woindega (Mid altitude)*. Twenty nine years (1968 – 2007) data from the nearby Metu Hospital Metrological station indicate a uni-modal rainfall pattern with 1836.7 mm of annual precipitation with maximum and minimum temperature of 26.92^{0}C and 12.42^{0}C respectively (Metu Wereda ARDCO 2004). Availability of abundant rainfall within the micro watershed and its altitude range has created a wide airy of opportunities to grow a number of crop types that are highly valuable such as *Coffea arabica* the major cash crop of the country as well for the project intervention community, maize the main stable food of the locals, sorghum, Teff, etc. It is also believed the agro-ecologic zone in which Wichi Micro Watershed f located is suitable for Vetiver grass to perform and flourish well.

The total area of Wichi Micro Watershed is 8149 hectares out of which 364 hectares or 4.5% is covered by Wichi Wetland alone. The landuse in the catchment is dominated by cultivated land which accounts for 54%, followed by coffee forest 23%, grazing land 3.5%, whilst settlement and other land use types accounting for the remaining 15% of the land use in the catchment (Metu Wereda ARDCO, 2004).

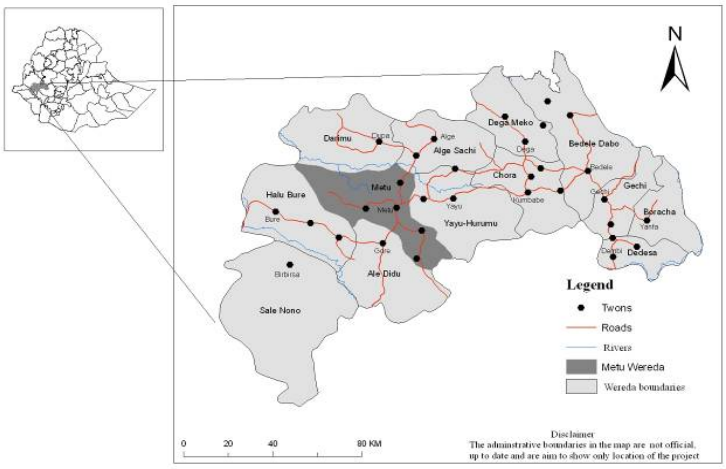

Figure 1. Location of Metu Woreda within Southwest Ethiopia

4. The problems prevailed within the micro watershed prior to project intervention

Within the Wichi Micro watershed the following major problems were prevailed before the project intervention and severely affected both the wetland and the catchment. The problems are highlighted in the following parts that have lead to the launching of the implementation of Wichi Integrated Wetland and Watershed Project.

~~4.1~~ Wetland scenario

Formatted: Bullets and Numbering

Wichi wetland system is used mainly for reed (*Cyperus spp*) supply for roofing or thatching purpose until the time that communities were forced to drain and grow crops within the wetland system. Following the 1985 country wide drought, during Derg Regime, the local communities were forced to drain Wichi Wetland for food production. Since then with increase in population size within the micro watershed the drainage in the wetland has continued to expand. The drainage activity was further intensified with the crop yield decline in the upslope where communities used to produce the bulk of food crops to fulfil their families' food requirement. With the increased pressure over years the wetland as a result started to degrade. Further the decline in water volume within the wetland has attracted additional wetland use type mainly grazing. Through time the grazing activity which once was practiced only in dry months of the year further extended to be undertaken in all the months of the year. Round year grazing and overstocking in the wetlands has further speeded up the processes of the wetland degradation. The situation was more complicated with expansion of coffee plantation upslope which demanded more land to produce food crop to feed more people. The gradual land use change in turn forced communities to look for additional alternatives for growing crops and mainly wetlands are the one available to full fill their food demand in close vicinity. In short draining coupled with all year round grazing completely stops the wetland from ecological recover by disrupting the normal flooding cycle. The situation has been further aggravated by the complete deforestation of the catchment for agricultural purpose except areas planted with coffee trees and where the forest is kept for coffee shading. The deforestation and conversion of the catchment into agricultural fields has altered the hydrological system of the catchment through reduced infiltration upslope and increased runoff. This has also affected the hydrological system within the wetland itself. With continuous wetland degradation due to the drainage, overgrazing and soil compaction with the wetland itself the water holding capacity of the wetland was severely affected hence the cycle of degradation was continued. This has created a negative impact on water holding capacity of the wetland and flow pattern.

Upslope cultivation with poor soil and water conservation measures has also impacted the wetland through siltation. Both deforestation and upslope cultivation with poor soil and water conservation, plus continuous drainage and overgrazing have affected the wetland environment and hence contributed for the decline in productivity of the wetland ecosystem and loss of biodiversity as well.

Furthermore, the run off has increased from the catchment and this has negatively impacted the wetland system. According to the information provided by the locals, Wichi wetland was erupted and a deep gorge was formed 24 years ago in the centre of the wetland that dissected the wetland into two parts. Since then the water quantity within the wetland started to decline and a total change in the hydrological system has appeared which was more aggravated with aforesaid problems and the negative impacts thereafter. The diverse wildlife

within the wetland has declined since cultivation was initiated in the wetland and finally some of the wildlife has become locally extinct. Once Wichi wetland was stocked with fish and currently there is no fish in Wichi wetland, it has gone decades before.

Moreover, continuous deforestation in the catchment has aggravated the level of run off into the wetland hence the outflow from the wetland has increased significantly during the rain season, when it is expected that the water should be stored within the system for slow flow later on. And a sharp decline in the outflow afterwards, when regular out flow was expected.

With all the changes occurring within the catchment Wichi wetland system has been changed over the years. Before the project intervention almost much of the wetland was drained and used for crop growing, whilst the remaining part of it was used for intensified year round grazing and small part of it was kept for reed growing. The pressure in the wetland as well in the catchment was intense and the wetland and the catchment ecosystems were under serious threat from the need for additional agricultural land with increased population. In order to reverse the situation (the ever increasing threat and the negative outcomes and impact) Ethio Wetlands has designed and implemented "Integrated Wichi Wetland and Watershed Project".

~~4.2~~ Crop productivity analysis and soil erosion in the micro watershed

Formatted: Bullets and Numbering

Maize is the dominant crop grown within Wichi catchment followed by Teff and sorghum. The productivity of these crops has declined over years due to poor soil and water management and poor crop husbandry. A study report by Yirgu (1996) revealed the productivity of soil decline within the catchment. The study result showed that between the years 1993 - 2002 a decline from 1700 kg/hectare to 1250 kg/hectare (25%) and 1400 kg/hectare to 800 kg/hectare (43%) for Maize and Sorghum respectively under traditional management with out any use of improved technology. Further a decline from 7000 kg/ha to 4000 kg/hectare (42.5%) was observed with the use of improved maize (BH – 660) crop between 1994/95 to 2001/02 cropping season in a farm land with 12% slope.

Further studies on catchment soil losses have revealed that the soil loss within Metu Wereda for cultivated lands exceeds 4.65 tonnes/ha./year (Kassaye 1996). Other study by Abate revealed a significant soil loss from a cultivated maize field within Metu Wereda. Abate (1994) reported a test plot results from the Dizi Research station a kebele within Metu Wereda for 1988 as 138.8 t/ha/yr of soil loss on a maize field with a 44% slope. A maize field with an 18% slope lost 18 t/ha/yr. A *teff* field on an 18% slope lost 30.7 t/ha/yr. Coffee forest with a 52% slope and grass fallow with a 32% slope both lost around 1 t/ha/yr. These results clearly indicate the deleterious effect of cultivation on hill slope soils in the Metu area.

5. Actions taken to combat the threat and arrest the environmental degradation

In order to mitigate the wetland and wetland resources degradation that was a result of mismanagement of the wetland resources coupled with soil erosion and siltaion, overgrazing within the wetland, intensive cultivation and deforestation within the catchment which contributed to the wetland degradation, a number of activities were undertaken. One of the key actions planned and implemented over the project life was undertaking physical soil and

water conservation activity within the catchment in long term to contribute towards wetland recovery as well. The physical conservation actions were focused around construction of Fanyajju terraces, soil bunds, water ways and cut off drain in order to reduce runoff from the upslope and halt soil and water erosion and increase water infiltration within the catchemnt. Further this action was sought to arrest water loss from the upslope mainly from the agricultural lands and conserve the water with the soil system and increase the water level within the wetland system through infiltration and underground water table recharging. As most of the land use within the micro watershed was dominated with cultivated land for cropping it was crucial to embark on the construction of conservation structures. Further tree planting and agro-forestry practices were undertaken in order to reduce the erosion level and halt soil degradation within the micro watershed. Over the project life, 820 kilometers of Fanya juu, 70.80 kms of soil bund, 4.65 kilometers of waterway, and 25.5 kilometers of cut-off drain were constructed within Wichi Micro Watershed over 1018 hectares.

Photo 2. Vetiver planted on Agricultural plots and its impact on the crop (see deep green leaves of Maize)

The second most visible and important component of the soil and water conservation action was to introduce Vetiver System for reinforcing the constructed physical soil and water conservation structures and ensure the sustainability of the conservation structures. As the constructed conservation structures could easily filled up with silt and melt down after couple of years, planting of Vetiver on the constructed physical soil and water conservation structures is crucial for sustainably addressing soil and water erosion problem and its negative impacts. Planting of Vetiver as much as possible and resource permits was done on all the physical conservation structures including Fanya juu, soil bund, waterways and cut off drains in order to stabilize the structures and create a sustainable out put from the action. Other major components of actions includes diversifying livelihood of the community though creating alternative income sources, water and sanitation, health and capacity building which will not be addressed in this paper.

6. Introduction of Vetiver for rehabilitating the wetland system and enhance soil and water conservation

6.1 History of Vetiver in Illu Aba Bora Zone

Various reports confirm that Vetiver (*Vetiveria zizanioides)* was introduced for the first time to Ethiopia most probably from India by an Indian Scientist through Coffee Plantation Corporation in early 1970 (National Research Council 1993). Then Vetiver was known to be introduced to Illu Aba Bora Zone and Metu Woreda in 1989 by an NGO known as Menshun für Menshun (MfM) which was operating in the area and still continued to operate in Illu Aba Bora Zone. MfM has propagated the plant within the organizations nurseries and distributed the planting material to small farmers to be planted and stabilize physical soil and water conservation structures constructed to address soil erosion problems through out the zone. The species that was promoted by the NGO was identified as *Vetiveria zizanioides* non flowering species and propagated through vegetative means. In most parts of Illu Aba Bora Zone there are lines of Vetiver grass scattered here and there in agricultural lands. Currently EWNRA is actively promoting Vetiver in Metu Woreda in more than ten kebeles as a major tool to combat soil and water erosion and wetland rehabilitation as well. Whilst in all of the Illu Aba Bora Zone woredas a promotion of Vetiver grass by the government agricultural offices is underway at a very low pace.

As one of important key component EWNRA through building on the experience it has gained from implementing Meko Gorbay Micro Watershed earlier and that of MfM it has launched in promoting Vetiver System in Wichi Micro Watershed for two main purposes. The first purpose was to combat soil and water erosion problem and secondly which was equally important through the first action to rehabilitate the wetland within the micro watershed.

6.2 Vetiver raising, distribution and planting

In order to arrest the environmental problems associated with soil and water erosion and further to rehabilitate the wetland EWNRA has established two nursery sites in the intervention micro watershed and raised more than 2,000,000 Vetiver planting slips and distributed for communities for planting. The distributed planting materials have been planted on 179 kms long physical soil and water conservation structures constructed mainly on Fanya juu, soil bund, waterways and cut off drains. These conservation structures were constructed by the local community members voluntarily almost all on agricultural plots. Planting was undertaken after two months of the onset of the main rain fall at the area. The main reason for farmers to delay the planting of Vetiver by two months after the main rainfall resumes locally is to avoid seasonal over lapping with crop planting as well to reduce any damage to the Vetiver slips planted during crop sowing. The seedlings were raised and managed within the project nurseries for at least ten months before distributed to the community for planting. Proper training was provided for community members on how the seedlings have to be planted and on post planting management.

Farmers were also encouraged to multiply Vetiver on their agricultural plots further through removing planting slips from those clumps that were already well established in the field in order to reduce the demand for more Vetiver seedlings from the project. Further they were

advised not to remove from clumps that are not well established and no disturbance is made for clumps that are in field for less than three years.

Photo 3. Well managed Vetiver in Sor Nursery ready for planting

Photo 4. Well established Vetiver in agricultural field – Wichi Metu

7. The outcomes from the promotion of Vetiver within the micro watershed

The reasons why EWNRA have focused in promoting Vetiver in the micro watershed are briefly articulated as follows.

- Through incorporating Vetiver to soil and water conservation work to address the environmental problems manifested within the micro watershed mainly wetland and upslope degradation due to soil erosion and siltation.

- Vetiver planting is considered to be a relatively more effective method of biological soil and water conservation that is believed to give better results in the protection and rehabilitation of the catchment and the wetland.
- Vetiver has the capacity to protect farm lands from soil erosion and runoff, thereby maintaining and also improving soil fertility, and retaining moisture in the soil over a longer period of time. This has a direct impact on land productivity and thus on the improvement in crop yields.
- Vetiver grass is believed to be a versatile grass that can serve various purposes. For example, the leaves can be used for thatching roofs, making mats, etc.
- Vetiver grass/leave is edible to animals in its early stages of growth. It would therefore serve as feed, and reduce the pressure of livestock grazing in the wetland.

The deliberate actions that were taken within the catchment which aimed to address the problems within the wetland over time have resulted in a positive out come within the wetland ecosystem. The positive impacts due to the project interventions include water quantity increase within the wetland which has a direct positive impact both on the wetland vegetation and wildlife. Due to increased water level in the wetland as a result of extensive soil and water conservation activities within the catchment the wetland vegetation re-emerged and water birds that were disappeared from the wetland years before started to come back to the wetland.

In summary the following improvements both in the wetland and the upslope was reported by the project beneficiaries, local staff, impact assessment report on project compilation and from observation made in the field from routine field visits to the project intervention micro watershed.

7.1 Wetland rehabilitation

Increase in water quantity within the wetland system
Gradually over two years period after the project implementation resumed and construction of physical soil and water conservation structures upslope and planting of Vetiver on the constructed structures was undertaken improvement within the wetland system become evident. The quantity of water accumulated within the wetland has increased and already on year two after project intervention commenced water was available all the year round in contrary to the only rain season availability prior to project intervention years. The wetland was full of water almost for most of the time whilst the pick reached during the main rain season in the area between May to August. There was a gradual out flow of water from the wetland and the wetland was with water even in the driest months of the year such as January to March. The report collated from the impact assessment study undertaken early this year (EWNRA 2009- under completion) through questioner survey has revealed that 60% of community members that was interviewed have reported that they have observed positive change and increase in the quantity of water within the wetland system compared to the pre project intervention era.

Photo 5. Wichi wetland with full of water at the end of the dry season

Decline in siltation within the wetland system

With runoff halted from the upslope the level of siltation within the wetland has reduced enormously as it was reported during the field discussion with the locals. The water that flows into the wetland system has become clean and the quantity of the silted water that flows into the wetland was significantly reduced. This has improved the quality of water hence the quality of the water at the out let of the wetland has shown significant improvement which is easily recognized with necked eyes as compared to pre project intervention time. The wetland and the lower lying grazing areas are now protected from silt accumulation that was easily washed and accumulated on the grazing land from the adjoining agricultural plots before the project intervention as repeatedly reported by the locals.

Improvement in biodiversity within the wetland

With the improvement in the water quantity in the wetland both the fauna and flora status within the wetland has started to improve and flourish. Wetland plant species that were disappeared from the wetland due to the wetland degradation has started to repair and those of non-wetland plant species gradually started to be replaced by wetland plant species. Communities have reported that plant species which are preferred for thatching purpose started to reappear in large quantity and their growth was increased. Before the project intervention to harvest *cheffe (Cyperus spp)* which is a common wetland plant species locally preferred for thatching local *tukules* (small grass huts) due to its quality and abundance was needed more than twelve months for its growth and maturity. However, with increased quantity of water within the wetland system the duration needed for *cheffe (Cyperus spp)* to mature and harvested for thatching purpose has almost reduced to nearly eight to ten months. Plant species such as *Kemete* that was fully colonized the wetland was gradually started to be replaced by other wetland species.

Further communities have reported the re-appearance of water birds in abundance such as ducks that were locally extinct due to severe wetland degradation and decline in water quantity within the wetland system due to the impact from reckless drainage practices, over grazing and soil compaction due to over stocking.

Photo 6. Water birds and the flourishing flora community as indicators of biodiversity recovery in the Wichi wetland

Wetland productivity increased

Productivity in parts of the wetland that is still cultivated has increased. As to the locals perception the increase in yield has attributed to the presence of more moisture during crop growing season through out in the wetland and decomposition of plant materials within the wetland system during the flooding seasons. Further weed species that were a main threat to the crop grown were significantly reduced due to complete flooding of the wetland after harvesting which is assumed to reduce the germination of those weed species.

7.2 Upslope

Soil erosion reduced and moisture conserved

As the result of the constructed soil and water conservation structures, locals has reported what they have perceived in that the rate of soil erosion is decreased significantly since the project intervention compared to the pre project era. Further the project impact study has reported that 76% of the interviewed households witnessed improvement of soil fertility within agricultural plots they owned. At field level observing silt accumulated adjacent to the Vetiver lines planted for conservation purpose is common which could be one of a proof for the decline in soil and water erosion within the intervention micro catchment.

Crop productivity improved

Due to the intervention of the project especially the construction of physical soil and water conservation structures over the last four years, a remarkable yield enhancement is observed especially on the production of Maize, Sorghum and Vegetables. Farmers are confidently speaking about the increase of their crop productions as the result of soil and water conservation activities undertaken and more adjacent farmers who have witnessed the reality have shown their interest to engage in the same activity.

Stable soil and water conservation structures across the micro watershed

Most of the physical soil and water conservation structures constructed to arrest soil erosion and water conservation disappear within two to there years since proper maintenance is not

practiced in and around Metu. However, with planting Vetiver on the constructed structures the structures have become more stable and providing the proper service needed from such structures.

7.3 Other benefits from Vetiver System for the locals

On top of the benefits that are highlighted above Vetiver System have many other socio-economic and environmental benefits that the locals are currently making use of it or tapping to it. This includes using Vetiver leaves for thatching and maintaining local huts, as a roofing material for constructed small tukuls for livestock, for grainier, for out door toilets, for rope making, etc.

Further a dried Vetiver leaves are used as a staffing material to make locally made mattresses and the fresh leaves are used for covering floors on main religious ceremonies and public holidays,

Vetiver is also planted around homestead to serve as an ornamental plant and keep out weeds from getting close to leaving quarters, stop homestead soil and water erosion as well.

Farmers has reported any fire let on farm plots between two well established Vetiver lines that exist on physical soil and water conservation structures will put off the fire before it expand to the neighboring plots. They recognized this as important if Vetiver is planted encircling their home in which unattended small fires that start in farm plots can't burn down their homes.

In other part of the country where EWNRA have intervention in Fogera Woreda near Lake Tana in Amhara Region Vetiver is used for making woven raincoats usually used by livestock herders during rain seasons. Traditionally this type of raincoats is made of grass species available in the area. However, with severe loss of this grasses due to uncontrolled human actions, Vetiver has replaced the role played by the grass and has become a preferable resource for making the raincoats due to its durability as well.

8. Challenges

Although the project has put all possible efforts to promote Vetiver within the intervention micro watershed it was not with out challenges. And some of the challenges are highlighted as follows.

- Severe financial limitation has restricted EWNRA to distribute sufficient Vetiver planting materials to the local community based on their demand,
- Vetiver needs a large area for raising seedlings for dissemination, and
- Vetiver leaves are not palatable once matured by livestock. In areas where there is sever feed shortage within the local communities it should be composted from other sources,

9. Conclusion and recommendation

Vetiver despite its importance for natural resources management such as combating soil and water erosion, wetland rehabilitation as illustrated in this paper and other uses its promotion is restricted or localized and undertaken by a few environmental organizations within the country. In order to tap its full benefits it is high time to start to think how this important grass could be disseminated through parts of the country where soil and water erosion and wetland degradation is severe. Ethiopia as a mountainous country as well as most of the rural dwellers depend on agriculture that is dominated by crop growing on slopes it is crucial important to promote Vetiver to address the critical problem of natural resources degradation through soil and water erosion and siltation in wetlands and water bodies.

References

Afework Hailu, A.B. Dixon and A.P. Wood, (2000). Nature, extent and trends in wetland drainage and use in Illu Aba Bora Zone, southwest Ethiopia. *(Report for Objective 1.)* Ethiopian Wetlands Research Programme (EWRP) and the University of Huddersfield, Metu and Huddersfield.

Metu Woreda Agricultural and Rural Development Coordination Office, (2004). Metu Wereda Basic Data, Metu Rural Development and Agricultural Coordination Office, Metu, Illu Aba Bora.

Environmental Protection of Ethiopia, (2004). Proceedings of the "National Consultative workshop on the Ramsar Convention and Ethiopia", March 18-19, 2004. Addis Ababa, Ethiopia.

Kassaye Goshu, (1996). Crises of Soils in Dizi, Anjeme, Mayabar, Aedit and Gub Lafto.

National Research Council, (1993). *Vetiver Grass: A Thin Green Line Against Erosion*, National Academy Press, Washington, D.C.

Oonyu, J.C., (2008). Wetlands education and awareness materials for tertiary institutions, a wetland manual designed for wetland practitioners.

Solomon Abate, (1994) *Land use dynamics, soil degradation and potential for sustainable use in Metu Area, Illubabor Region*, Ethiopia. Institute of Geography, University of Berne, African Studies Series A13, Berne, Switzerland. 135 pp.

Yirgu, (1996). Soils of Wichi and Koner, M.Sc Thesis, Alemya University of Agriculture.